

**MULTIMEDIA**



**UNIVERSITY**

**STUDENT ID NO**

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**MULTIMEDIA UNIVERSITY**

**FINAL EXAMINATION**

**TRIMESTER 1, 2017/2018**

**EBI4016 – BIOELECTRIC**

11 OCTOBER 2017  
2:30 p.m. – 4:30 p.m.  
(2 Hours)

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**INSTRUCTIONS TO STUDENT**

1. This Question paper consists of 3 pages including cover page with 5 Questions only.
2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

**Question 1**

- (a) Briefly describe excitable cells. [2 Marks]
- (b) Sketch the typical waveform of action potentials generated across the cell membrane of an excitable cell with appropriate labels for the important phases of this waveform. [4 Marks]
- (c) Briefly describe how an action potential is generated across the cell membrane of an excitable cell. [7 Marks]
- (d) Briefly describe the ion transport mechanisms (pump, active and passive channels) in the cell membrane in terms of its properties and functions. [7 Marks]

**Question 2**

- (a) It has been established in bioelectricity studies the phenomenon where a frog leg moves as a result of current passed through the nerve. This occurs when the muscle of the frog is simultaneously touched with a bimetallic arch. Why does this phenomenon occur and justify your answer in terms of electric currents, action potential and the stimulated nerve. [7 Marks]
- (b) Briefly describe over-potential of biopotential electrodes and explain the three types of over-potential in biopotential electrodes. [7 Marks]
- (c) Briefly describe a cardiac pacemaker [2 Marks]
- (d) Describe the four design requirements for implementing an implantable cardiac pacemaker. [4 Marks]

**Question 3**

- (a) Briefly describe an electroencephalogram (EEG). [2 Marks]
- (b) Describe the difference between the individual alpha, beta, theta and delta brain waves. [8 Marks]

**Continued...**

- (c) Describe the working principle of biopotential electrodes in terms of the oxidation-reduction reactions which are used for measuring bioelectric signals.

[10 Marks]

#### Question 4

- (a) Briefly describe cardiac fibrillation.

[4 marks]

- (b) Describe how a cardiac defibrillator functions to revive a patient who has just suffered from cardiac fibrillation.

[7 marks]

- (c) Nerve stimulation is the application of electric signals on the surface of the human body. Briefly describe how it works.

[5 marks]

- (d) State the benefits and problems associated with applying electrical stimulation on the surface of the human body compared to applying such stimulation inside the bodily tissues.

[4 marks]

#### Question 5

- (a) Briefly describe why transient protection is critical in electrocardiogram (ECG) amplifiers.

[4 marks]

- (b) Sketch a typical transient protection circuit and briefly describe the operation of this circuit towards protecting the ECG amplifiers.

[10 marks]

- (c) Briefly describe the let-go current.

[2 marks]

- (d) Briefly explain the types of electric shock which can be encountered in a medical environment.

[4 marks]

**End of Paper**